IP COMMUNICATION NETWORK SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates generally to a multi switched

5   network system (IP communication network system) capable of

reducing costs for equipment and operations by integrating a

switched circuit network such as a telephone network with an

IP (Internet Protocol) packet switched network such as the

Internet or the Intranet, and more particularly to an IP

10 communication interface device and a circuit switch for

facilitating a construction of this IP communication network

system.

With an advancement of a network technology as typified

by broadening the band of a local area network (LAN) and an

15 advancement of a PC technology as typified by attaining

multifunctions of a personal computer (PC) and a speed-up of

a CPU applied to the PC over the recent years, it is on the verge

of actualization in terms of utilization that voice data are

communicated at a high speed between the PCs on a plurality of

20 LANs.

Owing to the advancements of those technologies,

application software executed between the PCs on the Internet

(including the Intranet as far as it is not used in a particularly

limited terminology in this Specification) configured by the

25 LANs and wide area networks (WANs) and a hardware system

incorporating this package software, are rapidly put into the

market. This system is known as [Internet telephony].

In the IP communication network system known as Internet telephony, an integration of the data communications with the voice communications involves the use of a VoIP (Voice over Internet Protocol) technology. This VoIP technology is that

5   voices (audio data) are segmented into frames at an interval of a short time (on the order of, e.g., 20 sec), and transmitted and received in the form of packets by adding IP headers thereto on a network (IP network) based on a network layer protocol, i.e., Internet Protocol (IP) used on the Internet.

10   Further, there is promoted a development of an interface device, incorporating a gateway function for executing a communication protocol conversion between the telephone network and the Internet, for actualizing the communications between the telephone network and the Internet.

15   Generally, the Internet telephony can be operated at a lower cost than a speech (voice communication) on the phone through the conventional telephone network, and therefore a spread of the IP communication network system and services thereof is being accelerated.

20   A transmission (transfer) standard in this IP communication network system is not yet, however, established. What exists at the present is just ITU-T Recommendation H.450.2 (H.323) that defines the services within the Internet and the services in the conventional telephone network.

25   With diversification and a scale-up of the infrastructures for the communications, the users tend to separately use the communication infrastructure optimal to the purpose. Under

such circumstances, it is necessary and indispensable to construct a more economical intra-office communication network system by taking the Internet into the intra-office communication network system and utilizing it for the data communications and

5   the voice communications as well.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide an IP communication network system,

10   incorporating a gateway function for executing a communication protocol conversion between a telephone network (switched circuit network) and the Internet (IP packet switched network), for actualizing a variety of communications such as voice communications and data communications between the telephone

15   network and the Internet.

It is another object of the present invention to provide an IP communication network system capable of its being easily introduced into an existing telephone network, especially an intra-office telephone network in order to actualize the variety

20   of communications between the telephone network and the Internet.

To accomplish the above objects, according to a first aspect of the present invention, an IP communication interface device comprises first and second connecting units for making it possible to dispose between a switched circuit network and

25   LAN connected to an IP packet switched network, a first processing unit for coding first media-corresponding data as B-channel data inputted to the first connecting unit from the switched circuit

network, decoding packet-deassembled media-corresponding data
into which a packet of second media-corresponding data inputted
to the second connecting unit from the LAN is deassembled, and
for transmitting the decoded media-corresponding data to the
5   first connecting unit for forwarding the same data as the first
media-corresponding data to the switched circuit network, a
second processing unit for assembling the coded
media-corresponding data coded by the first processing unit into
a packet, deassembling the packet of the second
10   media-corresponding data, and transmitting the same data as
packet-deassembled media-corresponding data to the first
processing unit, and a third processing unit for generating the
second media-corresponding data by adding predetermined header
data to the packet-assembled media-corresponding data assembled
15   into a packet by the second processing unit, forwarding the second
media-corresponding data to the LAN via the second connecting
unit, removing the header data added to the second
media-corresponding data inputted to the second connecting unit,
and transmitting the second media-corresponding data with the
20   header data removed to the second processing unit.

Based on this architecture, the first and second
media-corresponding data may include voice data transmitted from
a voice terminal having a voice communication function, facsimile
data transmitted from a facsimile terminal having a facsimile
25   communication function and data transmitted from a data terminal
having a data communication function.

Further, the first and second processing units may be

functionally divided corresponding to the voice data, the facsimile data and the data that correspond to the first and second media-corresponding data, and the IP communication interface device may further comprise a selecting unit for

5 selecting the first functionally divided processing unit in accordance with a command given from the third processing unit.

The second processing unit, when the first media-corresponding data are the voice data or the facsimile data, may generate packet-assembled media-corresponding data

10 to which an RTP for enabling a real time transport to be done is added.

The second processing unit, when the second media-corresponding data are the voice data or the facsimile data, may generate packet-deassembled media-corresponding data

15 from which the RTP for enabling the real time transport to be done is removed.

The third processing unit, when the packet-assembled media-corresponding data generated by the second processing unit are the voice data or the facsimile data, may add a UDP header

20 and an IP header as the header data, and, when the packet-assembled media-corresponding data are the essential data, may add a TCP header and an IP header as the header data.

The third processing unit, when the second media-corresponding data are the voice data or the facsimile

25 data, may remove the UDP header and the IP header added as the header data, and, when the second media-corresponding data are the essential data, may remove the TCP header and the IP header

added as the header data.

The third processing unit may identify a call control signal as D-channel data in accordance with a message based on a specified protocol, and may penetratingly transmit and receive 5 the call control signal simply by adding and removing the TCP header and the IP header.

The first and second connecting units and the first, second and third processing units may be mounted in a package card.

According to a second aspect of the present invention, 10 a circuit switch comprises a highway switch accommodating at least one of a voice terminal having a voice communication function, a facsimile terminal having a facsimile function and a data terminal having a data communication function, and including a time division multiplexing transmission path for 15 transmitting data corresponding to media, a first connecting unit connected directly to the highway switch, a second connecting unit for accommodating a LAN line connected to an IP packet switched network, a first processing unit for coding first media-corresponding data as B-channel data inputted to 20 the first connecting unit, decoding packet-deassembled media-corresponding data into which a packet of second media-corresponding data inputted to the second connecting unit is deassembled, and transmitting the decoded media-corresponding data to the first connecting unit in order 25 to forward the same decoded media-corresponding data as the first media-corresponding data to the highway switch, a second processing unit for assembling the coded media-corresponding

data coded by the first processing unit, deassembling the packet

of the second media-corresponding data, and transmitting the

second media-corresponding data as the packet-deassembled

media-corresponding data to the first processing unit, and a

5   third processing unit for generating the second

media-corresponding data by adding predetermined header data

to the packet-assembled media-corresponding data assembled into

a packet by the second processing unit, forwarding the second

media-corresponding data to the LAN via the second connecting

10   unit, removing the header data added to the second

media-corresponding data inputted to the second connecting unit,

and transmitting the second media-corresponding data with the

header data removed to the second processing unit.

According to a third aspect of the present invention, an

15   IP communication network system includes a circuit switch

comprising a highway switch accommodating at least one of a voice

terminal having a voice communication function, a facsimile

terminal having a facsimile function and a data terminal having

a data communication function, and including a time division

20   multiplexing transmission path for transmitting data

corresponding to media, a first connecting unit connected

directly to the highway switch, a second connecting unit for

accommodating a LAN line connected to an IP packet switched

network, a first processing unit for coding first

25   media-corresponding data as B-channel data inputted to the first

connecting unit, decoding packet-deassembled

media-corresponding data into which a packet of second

media-corresponding data inputted to the second connecting unit

is deassembled, and transmitting the decoded

media-corresponding data to the first connecting unit in order

to forward the same decoded media-corresponding data as the first

5   media-corresponding data to the highway switch, a second

processing unit for assembling the coded media-corresponding

data coded by the first processing unit, deassembling the packet

of the second media-corresponding data, and transmitting the

second media-corresponding data as the packet-deassembled

10   media-corresponding data to the first processing unit, and a

third processing unit for generating the second

media-corresponding data by adding predetermined header data

to the packet-assembled media-corresponding data assembled into

a packet by the second processing unit, forwarding the second

15   media-corresponding data to the LAN via the second connecting

unit, removing the header data added to the second

media-corresponding data inputted to the second connecting unit,

and transmitting the second media-corresponding data with the

header data removed to the second processing unit.

20   According to a fourth aspect of the present invention,

an IP communication network system includes an IP communication

interface device comprising first and second connecting units

for making it possible to dispose between a switched circuit

network and LAN connected to an IP packet switched network, a

25   first processing unit for coding first media-corresponding data

as B-channel data inputted to the first connecting unit from

the switched circuit network, decoding packet-deassembled

media-corresponding data into which a packet of second media-corresponding data inputted to the second connecting unit from the LAN is deassembled, and for transmitting the decoded media-corresponding data to the first connecting unit for

5   forwarding the same data as the first media-corresponding data to the switched circuit network, a second processing unit for assembling the coded media-corresponding data coded by the first processing unit into a packet, deassembling the packet of the second media-corresponding data, and transmitting the same data

10 as packet-deassembled media-corresponding data to the first processing unit, and a third processing unit for generating the second media-corresponding data by adding predetermined header data to the packet-assembled media-corresponding data assembled into a packet by the second processing unit, forwarding the second

15 media-corresponding data to the LAN via the second connecting unit, removing the header data added to the second media-corresponding data inputted to the second connecting unit, and transmitting the second media-corresponding data with the header data removed to the second processing unit.

20   According to the present invention, it is feasible to provide the IP communication network system, incorporating the gateway function for executing the communication protocol conversion between the telephone network (switched circuit network) and the Internet (IP packet switched network), for

25 actualizing the variety of communications such as the voice communications and the data communications between the telephone network and the Internet.

According to the present invention, it is also possible to provide the IP communication network system capable of its being easily introduced into the existing telephone network, especially the intra-office telephone network in order to actualize the variety of communications between the telephone network and the Internet.

As a result, according to the present invention, it is easier to construct the economical circuit switch and IP communication network system.

BRIEF DESCRIPTION OF THE DRAWINGS

These objects and advantages of the present invention will become more apparent and more readily appreciated from the following detailed description of the presently preferred exemplary embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a block diagram showing an architecture of an IP communication network system in one embodiment of the present invention;

FIG. 2 is an explanatory block diagram showing a first example of a private branch exchange (PBX) and an IP communication interface device and operations thereof;

FIG. 3 is a diagram showing a layout of a control unit and CODECs that are mounted as a package card in the IP communication interface device;

FIG. 4 is an explanatory diagram showing a frame structure of a variety of packets transmitted and received between the

IP communication interface device and a LAN line (Internet line);

FIG. 5 is an explanatory block diagram showing a second example of the PBX and the IP communication interface device and operations thereof;

5   FIG. 6 is an explanatory block diagram showing a third example of the PBX and the IP communication interface device and operations thereof; and

FIG. 7 is an explanatory block diagram showing a fourth example of the PBX and the IP communication interface device

10   and operations thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Next, embodiments of the present invention will hereinafter be discussed with reference to the accompanying drawings.

15   [Architecture of IP Communication Network System]

FIG. 1 shows an architecture of an IP communication network system in one embodiment of the present invention. Referring to FIG. 1, PBXs (private branch exchanges) 1, 2 configuring a telephone network as a switched circuit network respectively

20   accommodate a plurality of terminal devices (which may be simply referred to as terminals in some cases) 3 and a plurality of terminals 4. These terminal 3, 4 are each classified as a telephone terminal incorporating a voice communication function, and a facsimile (FAX) terminal having a FAX communication

25   function, or a data terminal such as a personal computer (PC) having a data communication function. Note that the PBXs 1, 2 may also be main devices corresponding to typical PBXs. Further,

the PBXs 1, 2 are connected to an ISDN relay line to a public switched network, however, their illustrations are herein omitted.

IP communication interface devices 5, 6 serve to connect the PBXs 1, 2 to local area networks (LANs) 7, 8, respectively. The IP communication interface devices 5, 6, which will hereinafter be described in depth, can be provided as package cards into the same boxes as those of the PBXs 1, 2. Unique IP addresses are allocated to the IP communication interface devices 5, 6.

In addition to the IP communication interface devices 5, 6, data terminals (not shown) such as PCs each having the data communication function and routers 9, 10 serving as relay (routing) devices, are connected to the LANs 7, 8. The LANs 7, 8 are configured based on a star network topology such as 10BASE-T (in which a trunk line transmission speed is 10 Mpbs, a base band modulation method is adopted, and a transmission medium involves the use of a twisted pair cable) or 100BASE-TX, and may also be configured by using other network topologies such as a bus network.

An Internet 11 as an IP packet switched network (IP network) is connected to the routers 9, 10. This Internet 11 is strictly categorized as the Intranet when the IP packet switched network is an intra-office network, however, there is herein no particular distinction in terminology. Further, the Internet 11 is constructed of a leased line, ISDN LAN and WAN. The IP communication network system can be configured based on this

architecture.

[First Example of Architectures and Operations of Private Branch Exchange and IP communication Interface Device]

(Private Branch Exchange)

5   A first PBX 20 corresponding to the PBXs 1, 2 in IP communication network system shown in FIG. 1, as illustrated in FIG. 2, includes a voice terminal (subscriber) control unit 21, a highway switch 22, a trunk control unit 23 and a central control unit 24.

10   The voice terminal control unit 21 accommodates a voice terminal (telephone) 31 incorporating a voice communication function through a subscriber line, and is connected to the highway switch 22. The voice terminal control unit 21 controls detection of calling, response and disconnection, controls a

15   receipt of dialing and controls a calling signal with respect to the voice terminal 31. The voice terminal control unit 21 also controls receiving operations when the voice terminal 31 is set on a receiving side.

The highway switch 22 is constructed of a time division

20   multiplexing transmission path (Highway: HW) having [nB + D] (n = 1 ~ 31) channels, and has a capacity of, e.g., 2 Mbps (64 Kbps X 32 time slots TS). The trunk control unit 23 accommodates an ISDN relay line of BRI (Basic Rate Interface, which is a basic interface having a transmission speed of 192 Kbps) or PRI (Primary

25   Rate Interface, which is a primary group speed interface having a transmission speed of 1.544/2.048 Mbps) that is connected to the public switched network. The trunk control unit 23 serves

to transmit and receive voice data (Bch data) of a B channel and control data (Dch data) of a D channel. Further, the trunk control unit 23 is connected directly to the highway switch 22.

The central control unit 24 switches the lines by controlling the voice terminal control unit 21, the highway switch 22 and the trunk control unit 23, respectively. Moreover, the central control unit 24 executes setting, canceling and outputting of station data via a maintenance/operation interface (unillustrated).

(IP Communication Interface Device)

Next, a first IP communication interface device 40 corresponding to the IP communication interface devices 5, 6 in the IP communication network system shown in FIG. 1, as illustrated in FIG. 2, includes a control unit 50 and a CODEC 60. The control unit 50 and the CODEC 60 are constructed of an individual or one piece of package card, and this package card is mounted as the IP interface device 40 into the same box as that of the PBX 20 described above. FIG. 3 is a diagram showing a layout of the control unit 50 and the CODECs 60, which are mounted in the single package card.

The control unit 50 comprises a highway switch interface (that will hereinafter be abbreviated to HW-IF in some cases) 51, a LAN interface (that will hereinafter be abbreviated to LAN-IF as the case may be) 52, a signal processing unit 53 provided in a CPU (Central Processing Unit), and an internal bus 54. The control unit 50 transmits and receives packets corresponding to media with an Internet line via a LAN line, which are voice

packets in this example. Further, the control unit 50 is connected to the highway switch 22 of the PBX 20 and to the LANs 7, 8, and controls the CODECs 60 to assemble and deassemble the packets of data corresponding to the media, i.e., the voice data

5   in this example.

The HW-IF 51 connected directly to the highway of the highway switch 22 takes line data of 64 Kbps out of this highway (a transmission speed thereof is, e.g., 2 Mbps) and inserts the line data of 64 Kbps into the highway of the highway switch 22.

10   The LAN-IF 52 is connected to the LANs 7, 8 and controls electric/physical interfaces of the LAN lines in the LAN topology, i.e., 10BASE-T or 100BASE-TX in this example. The signal processing unit 53 establishes calls between connection type communications on the side of the switched circuit network of

15   the PBX 20 and connectionless type communications on the side of the Internet, and processes an end call control signal.

Further, the CODEC 60 connected to the control unit 50 is constructed of a dropper/inserter (which hereinafter might be referred to as TS-CNTL) 61, a dual port memory (which

20   hereinafter might be termed DPRAM) 62, a first processing unit 62 composed of a digital signal processor (DSP) and having a coding/decoding function, a second processing unit 64 provided in the CPU and having a packet assembling/deassembling function, and an internal bus 65. The CODEC 60 assembles and deassembles

25   the packet of the data corresponding to the media, i.e., the voice data in this example.

The TS-CONTL 61 takes the data out of a 64 Kbps time slot

of an internal transmission path between the control unit 50 and the CODEC 60, and inserts the data into the same time slot. The DPRAM 62 enables the signal processing unit 53 of the control unit 50 and the second processing unit 64 of the CODEC 60 to

5   perform the internal communications therebetween.

The first processing unit 63 executes a process of coding continuous signals of the voice data taken out of the time slot in the TS-CNTL 61 into discrete signals of the voice packet to the Internet line. Further, the first processing unit 63

10   executes a process of decoding the voice packet forwarded from the Internet line into the continuous signals of the voice data, whereby the decoded signals can be inserted into the predetermined time slot in the TS-CNTL 61.

The second processing unit 64 controls the first processing

15   unit 63, and executes the packet assembly including an addition of RTP (Real Time Transport Protocol) for enabling a real time transport to be carried out and a packet deassembly including an elimination of RTP. Note that the CODECs 60 are extensible corresponding to an increase in the number of output channels

20   to the LANs 7, 8 from the IP communication interface device 40.

The IP communication interface device 40 is connected directly to the highway of the highway switch 22 via the HW-IF 51, and may therefore be treated as a [trunk device] embraced by the ISDN relay line as viewed from the PBX 20.

25   (Operation)

In the first IP communication interface device 40 taking the architecture described above, the voice data (Bch data) are

inputted via the HW-IF 51 of the control unit 50 to the TS-CNTL 61 of the CODEC 60 from the highway switch 22 of the PBX 20.

The voice data inputted to the TS-CNTL 61 are coded in the first processing unit 63 and subjected to a voice compression

5   and a silence compression according to ITU-T G.729 Annex A/B. The coded voice data, which have been thus compressed, are transmitted to the second processing unit 64 via the internal bus 65 from the first processing unit 63. The second processing unit 64 adds RTP to the coded voice data, thereby assembling

10 a voice packet. This voice packet is transferred to the signal processing unit 53 of the control unit 50 via the DPRAM 62 and the internal bus 54 as well.

The signal processing unit 53 assembles a voice packet by adding a UDP (User Datagram Protocol) header and an IP (Internet

15 Protocol) header to the former voice packet received from the CODEC 60, and forwards this assembled voice packet to the LAN lines connected to the LANs 7, 8 via the LAN-IF 52. FIG. 4(A) shows a frame structure of the voice packet on the LAN line and the Internet line.

20   Further, the control data (Dch data) of the call control signal etc corresponding to a TTC Standard JT-Q.931 message, are inputted to the signal processing unit 53 via the HW-IF 51 of the control unit 50 and the internal bus from the highway switch 22 of the PBX 20.

25   The signal processing unit 53 assembles a control data packet based on a frame structure shown in FIG. 4(D) by adding a TCP (Transmission Control Protocol) header and an IP header

to the received control data. This control data packet is forwarded to the LAN lines connected to the LANs 7, 8 via the LAN-IF 52.

On the other hand, when the voice packet is inputted to
5   the IP communication interface device 40 from the LAN line, the voice packet is deassembled and decoded into Bch voice data through processing steps opposite to those described above. The Bch voice data are then transmitted to the highway switch 22 of the PBX 20.

10   Further, when the control data packet is inputted to the IP communication interface device 40 from the LAN line, the packet is deassembled through processing steps opposite to those explained above into Dch control data, and the Dch control data are transmitted to the highway switch 22 of the PBX 20. Namely,
15   the IP communication interface device 40 transparently transmits and receives the control data between the PBX 20 and the LANs 7, 8.

[Second Example of Architectures and Operations of Private Branch Exchange and IP communication Interface Device]
20   (Private Branch Exchange)

A second PBX 20 corresponding to the PBXs 1, 2 in IP communication network system shown in FIG. 1, as illustrated in FIG. 5, includes a facsimile (FAX) terminal control unit 25, the highway switch 22, the trunk control unit 23 and the central
25   control unit 24.

The FAX terminal control unit 25 accommodates a facsimile (FAX) terminal (telephone) 32 incorporating a FAX

communication function through a FAX line, and is connected to the highway switch 22. The FAX terminal control unit 25 controls a transmission, a receipt and a disconnection with respect to the FAX terminal 32.

5   The highway switch 22 is constructed of a time division multiplexing transmission path (Highway: HW) having [nB + D] (n = 1 ~ 31) channels, and has a capacity of, e.g., 2 Mbps (64 Kbps X 32 time slots TS). The trunk control unit 23 accommodates the ISDN relay line of BRI or PRI that is connected to the public 10   switched network. The trunk control unit 23 serves to transmit and receive FAX data (Bch data) of the B channel and control data (Dch data) of the D channel. Further, the trunk control unit 23 is connected directly to the highway switch 22.

The central control unit 24 switches the lines by 15   controlling the FAX terminal control unit 25, the highway switch 22 and the trunk control unit 23, respectively. Moreover, the central control unit 24 executes setting, canceling and outputting of station data via the maintenance/operation interface (unillustrated).

20   (IP Communication Interface Device)

Next, a second IP communication interface device 40 corresponding to the IP communication interface devices 5, 6 in the IP communication network system shown in FIG. 1, as illustrated in FIG. 5, includes the control unit 50 and a CODEC 25   70. The control unit 50 and the CODEC 70 are constructed of an individual or one piece of package card, and this package card is mounted as the IP interface device 40 into the same box

as that of the PBX 20 described above. A layout of the control
unit 50 and the CODECs 70, which are mounted in the single package
card, is the same as that shown in FIG. 3.

The control unit 50 comprises the highway switch interface
5   (HW-IF) 51, the LAN interface (LAN-IF) 52, the signal processing
unit 53 provided in the CPU, and the internal bus 54.   The control
unit 50 transmits and receives packets corresponding to media
with the Internet line via the LAN line, which are FAX packets
in this example. Further, the control unit 50 is connected to
10   the highway switch 22 of the PBX 20 and to the LANs 7, 8, and
controls the CODECs 70 to assemble and deassemble the packets
of data corresponding to the media, i.e., the FAX data in this
example.

The HW-IF 51 connected directly to the highway of the
15   highway switch 22 takes line data of 64 Kbps out of this highway
(the transmission speed thereof is, e.g., 2 Mbps) and inserts
the line data of 64 Kbps into the highway of the highway switch
22.   The LAN-IF 52 is connected to the LANs 7, 8 and controls
the electric/physical interfaces of the LAN lines in the LAN
20   topology, i.e., 10BASE-T or 100BASE-TX in this example. The
signal processing unit 53 establishes calls between the
connection type communications on the side of the switched
circuit network of the PBX 20 and the connectionless type
communications on the side of the Internet, and processes the
25   end call control signal.

Further, the CODEC 70 connected to the control unit 50
is constructed of a dropper/inserter (TS-CNTL) 71, a dual port

memory (DPRAM) 72, a first processing unit 73 composed of a digital
signal processor (DSP) and having a coding/decoding function,
a second processing unit 74 provided in the CPU and having a
packet assembling/deassembling function, and an internal bus

5   75.   The CODEC 70 assembles and deassembles the packet of the
data corresponding to the media, i.e., the FAX data in this
example.

The TS-CONTL 71 takes the data out of a 64 Kbps time slot
of an internal transmission path between the control unit 50

10   and the CODEC 70, and inserts the data into the same time slot.
The DPRAM 72 enables the signal processing unit 53 of the control
unit 50 and the second processing unit 74 of the CODEC 70 to
perform the internal communications therebetween.

The first processing unit 73 executes a process of coding

15   continuous signals of the FAX data taken out of the time slot
in the TS-CNTL 71 into discrete signals of the FAX packet to
the Internet line. Further, the first processing unit 73 executes
a process of decoding the FAX packet forwarded from the Internet
line into the continuous signals of the FAX data, whereby the

20   decoded signals can be inserted into the predetermined time slot
in the TS-CNTL 71.

The second processing unit 74 controls the first processing
unit 73, and executes the packet assembly including the addition
of RTP for enabling the real time transport to be carried out

25   and a packet deassembly including the elimination of RTP.   Note
that the CODECs 70 are extensible corresponding to an increase
in the number of output channels to the LANs 7, 8 from the IP

communication interface device 40.

The second IP communication interface device 40 is connected directly to the highway of the highway switch 22 via the HW-IF 51, and may therefore be treated as the [trunk device]

5 embraced by the ISDN relay line as viewed from the PBX 20.

(Operation)

In the second IP communication interface device 40 taking the architecture described above, the FAX data (Bch data) having a transmission speed of G3 are inputted via the HW-IF 51 of the

10 control unit 50 to the TS-CNTL 71 of the CODEC 70 from the highway switch 22 of the PBX 20.

The FAX data inputted to the TS-CNTL 71 are coded based on a FAX relay method of FRP.11 in the first processing unit 73 having automatically detected inter-FAX-terminal signals.

15 The coded FAX data are transmitted to the second processing unit 74 via the internal bus 75 from the first processing unit 73. The second processing unit 74 adds RTP to the coded FAX data, thereby assembling a FAX packet. This FAX packet is transferred to the signal processing unit 53 of the control unit

20 50 via the DPRAM 72 and the internal bus 54 as well.

The signal processing unit 53 assembles a FAX packet by adding a UDP header and an IP header to the former FAX packet received from the CODEC 70, and forwards this assembled FAX packet to the LAN lines connected to the LANs 7, 8 via the LAN-IF 52.

25 FIG. 4(B) shows a frame structure of the FAX packet on the LAN line and the Internet line.

On the other hand, when the FAX packet is inputted to the

IP communication interface device 40 from the LAN line, the FAX packet is deassembled and decoded into Bch FAX data through processing steps opposite to those described above. The Bch FAX data are then transmitted to the highway switch 22 of the

5   PBX 20.

Note that the processes of transmitting and receiving the control data (Dch data) of the call control signal etc corresponding to the TTC Standard JT-Q.931 message in this IP communication interface device 40, are the same as those in the

10   first IP communication interface device 40 described above.

[Third Example of Architectures and Operations of Private Branch Exchange and IP communication Interface Device]

(Private Branch Exchange)

A third PBX 20 corresponding to the PBXs 1, 2 in IP

15   communication network system shown in FIG. 1, as illustrated in FIG. 6, includes a data terminal control unit 26, the highway switch 22, the trunk control unit 23 and the central control unit 24.

The data terminal control unit 26 accommodates a data

20   terminal 33 incorporating a data communication function through a data line, and is connected to the highway switch 22. The data terminal control unit 26 controls a transmission and a receipt with respect to the data terminal 33.

The highway switch 22 is constructed of a time division

25   multiplexing transmission path (Highway: HW) having [nB + D] (n = 1 ~ 31) channels, and has a capacity of, e.g., 2 Mbps (64 Kbps X 32 time slots TS). The trunk control unit 23 accommodates

the ISDN relay line of BRI or PRI that is connected to the public
switched network. The trunk control unit 23 serves to transmit
and receive 64 Kbps non-limited digital data (Bch data) of the
B channel and control data (Dch data) of the D channel. Further,
5 the trunk control unit 23 is connected directly to the highway
switch 22.

The central control unit 24 switches the lines by
controlling the data terminal control unit 26, the highway switch
22 and the trunk control unit 23, respectively. Moreover, the
10 central control unit 24 executes setting, canceling and
outputting of station data via the maintenance/operation
interface (unillustrated).

(IP Communication Interface Device)

Next, a third IP communication interface device 40
15 corresponding to the IP communication interface devices 5, 6
in the IP communication network system shown in FIG. 1, as
illustrated in FIG. 6, includes the control unit 50 and a CODEC
80. The control unit 50 and the CODEC 80 are constructed of
an individual or one piece of package card, and this package
20 card is mounted as the IP interface device 40 into the same box
as that of the PBX 20 described above. A layout of the control
unit 50 and the CODECs 80, which are mounted in the single package
card, is the same as that shown in FIG. 3.

The control unit 50 comprises a highway switch interface
25 (HW-IF) 51, a LAN interface (LAN-IF) 52, a signal processing
unit 53 provided in the CPU, and an internal bus 54. The control
unit 50 transmits and receives packets corresponding to media

with the Internet line via the LAN line, which are data packets in this example. Further, the control unit 50 is connected to the highway switch 22 of the PBX 20 and to the LANs 7, 8, and controls the CODECs 80 to assemble and deassemble the packets

5   of data corresponding to the media in this example.

The HW-IF 51 connected directly to the highway of the highway switch 22 takes line data of 64 Kbps out of this highway (a transmission speed thereof is, e.g., 2 Mbps) and inserts the line data of 64 Kbps into the highway of the highway switch 22.

10 The LAN-IF 52 is connected to the LANs 7, 8 and controls the electric/physical interfaces of the LAN lines in the LAN topology, i.e., 10BASE-T or 100BASE-TX in this example. The signal processing unit 53 establishes calls between the connection type communications on the side of the switched circuit network of

15 the PBX 20 and the connectionless type communications on the side of the Internet, and processes the end call control signal.

Further, the CODEC 80 connected to the control unit 50 is constructed of a dropper/inserter (TS-CNTL) 81, a dual port memory (DPRAM) 82, a first processing unit 83 composed of a digital

20 signal processor (DSP) and having a coding/decoding function, a second processing unit 84 provided in the CPU and having a packet assembling/deassembling function, and an internal bus 85. The CODEC 80 assembles and deassembles the packet of the data corresponding to the media in this example.

25 The TS-CONTL 81 takes the data out of a 64 Kbps time slot of an internal transmission path between the control unit 50 and the CODEC 80, and inserts the data into the same time slot.

The DPRAM 82 enables the signal processing unit 53 of the control unit 50 and the second processing unit 84, which will be explained later on, of the CODEC 80 to perform the internal communications therebetween.

5   The first processing unit 83 executes a process of coding continuous signals of the data taken out of the time slot in the TS-CNTL 81 into discrete signals of the data packet to the Internet line. Further, the first processing unit 83 executes a process of decoding the data packet forwarded from the Internet line into the continuous signals of the data, whereby the decoded signals can be inserted into the predetermined time slot in the TS-CNTL 81. Note that the first processing unit 83 neither compresses nor extends the data, and, instead, there may be taken a process of merely letting the data through.

15   The second processing unit 84 controls the first processing unit 83, and assembles and deassembles the packets. Note that the CODECs 80 are extensible corresponding to an increase in the number of output channels to the LANs 7, 8 from the IP communication interface device 40.

20   The third IP communication interface device 40 described above is connected directly to the highway of the highway switch 22 via the HW-IF 51, and may therefore be treated as a [trunk device] embraced by the ISDN relay line as viewed from the PBX 20.

25   (Operation)

In the third IP communication interface device 40 taking the architecture described above, the 64 Kbps non-limited digital

data (Bch data) excluding the FAX data having the transmission speed of G3 are inputted via the HW-IF 51 of the control unit 50 to the TS-CNTL 81 of the CODEC 80 from the highway switch 22 of the PBX 20.

5   The data inputted to the TS-CNTL 81 are coded in the first processing unit 83.   The coded data are transmitted to the second processing unit 84 via the internal bus 85 from the first processing unit 83.   The second processing unit 84, based on the coded data, assembles a data packet.   This data packet is

10   transferred to the signal processing unit 53 of the control unit 50 via the DPRAM 82 and the internal bus 54 as well.

        The signal processing unit 53 assembles a data packet by adding a TCP header and an IP header to the former data packet received from the CODEC 80, and forwards this assembled data

15   packet to the LAN lines connected to the LANs 7, 8 via the LAN-IF 52.   FIG. 4(C) shows a frame structure of the data packet on the LAN line and the Internet line.

        On the other hand, when the data packet is inputted to the IP communication interface device 40 from the LAN line, the

20   data packet is deassembled and decoded into Bch data through processing steps opposite to those described above.   The Bch data are then transmitted to the highway switch 22 of the PBX 20.

        Note that the processes of transmitting and receiving the

25   control data (Dch data) of the call control signal etc corresponding to the TTC Standard JT-Q.931 message in this IP communication interface device 40, are the same as those in the

first IP communication interface device 40 described above.

[Fourth Example of Architectures and Operations of Private Branch Exchange and IP communication Interface Device]

(Private Branch Exchange)

5   A fourth PBX 20 corresponding to the PBXs 1, 2 in IP communication network system shown in FIG. 1, as illustrated in FIG. 7, includes the voice terminal (subscriber) control unit 21, the facsimile (FAX) terminal control unit 25, the highway switch 22, the trunk control unit 23 and the central control

10   unit 24.

The voice terminal control unit 21 accommodates a voice terminal (telephone) 31 corresponding to the communication terminal devices 3, 4 and incorporating a voice communication function through a subscriber line, and is connected to the

15   highway switch 22. The voice terminal control unit 21 controls detection of calling, response and disconnection, controls a receipt of dialing and controls a calling signal with respect to the voice terminal 31. The voice terminal control unit 21 also controls receiving operations when the voice terminal 31

20   is set on a receiving side.

The FAX terminal control unit 25 accommodates a facsimile (FAX) terminal 32 corresponding to the communication terminal devices 3, 4 and incorporating a FAX communication function through a FAX line, and is connected to the highway switch 22.

25   The FAX terminal control unit 25 controls a transmission, a receipt and a disconnection with respect to the FAX terminal 32.

The data terminal control unit 26 accommodates a data terminal 33 such as a PC corresponding to the communication terminal devices 3, 4 and incorporating a data communication function through a data line, and is connected to the highway

5   switch 22. The data terminal control unit 26 controls a transmission and a receipt with respect to the data terminal 33.

The highway switch 22 is constructed of a time division multiplexing transmission path (Highway: HW) having [nB + D]

10   (n = 1 ~ 31) channels, and has a capacity of, e.g., 2 Mbps (64 Kbps X 32 time slots TS). The trunk control unit 23 accommodates the ISDN relay line of BRI or PRI that is connected to the public switched network. The trunk control unit 23 serves to transmit and receive the voice data, the FAX data or the data (Bch data)

15   of the B channel and control data (Dch data) of the D channel. Further, the trunk control unit 23 is connected directly to the highway switch 22.

The central control unit 24 switches the lines by controlling the voice terminal control unit 21, the FAX terminal

20   control unit 25, the data terminal control unit 26, the highway switch 22 and the trunk control unit 23, respectively. Moreover, the central control unit 24 executes setting, canceling and outputting of station data via the maintenance/operation interface (unillustrated).

25   (IP Communication Interface Device)

Next, a fourth IP communication interface device 40 corresponding to the IP communication interface devices 5, 6

in the IP communication network system shown in FIG. 1, as illustrated in FIG. 7, includes the control unit 50 and a CODEC 90. The control unit 50 and the CODEC 90 are constructed of an individual or one piece of package card, and this package

5 card is mounted as the IP interface device 40 into the same box as that of the PBX 20 described above. A layout of the control unit 50 and the CODECs 90, which are mounted in the single package card, is the same as that shown in FIG. 3.

The control unit 50 comprises the highway switch interface

10 (HW-IF) 51, the LAN interface (LAN-IF) 52, the signal processing unit 53 provided in the CPU, and the internal bus 54. The control unit 50 transmits and receives packets corresponding to media with the Internet line via the LAN line, which are the voice packets, the FAX packets or the data packets. Further, the

15 control unit 50 is connected to the highway switch 22 of the PBX 20 and to the LANs 7, 8, and controls the CODECs 90 to assemble and deassemble the packets of data corresponding to the media.

The HW-IF 51 connected directly to the highway of the highway switch 22 takes line data of 64 Kbps out of this highway

20 (the transmission speed thereof is, e.g., 2 Mbps) and inserts the line data of 64 Kbps into the highway of the highway switch 22. The LAN-IF 52 is connected to the LANs 7, 8 and controls the electric/physical interfaces of the LAN lines in the LAN topology, i.e., 10BASE-T or 100BASE-TX in this example. The

25 signal processing unit 53 establishes calls between the connection type communications on the side of the switched circuit network of the PBX 20 and the connectionless type

communications on the side of the Internet, and processes the
end call control signal.

Further, the CODEC 90 connected to the control unit 50
is constructed of a dropper/inserter (TS-CNTL) 91, a dual port

5   memory (DPRAM) 92, a first voice processing unit 931, a first
FAX processing unit 932 and a first data processing unit 933
each composed of a digital signal processor (DSP) and having
a coding/decoding function, a second voice processing unit 941,
a second FAX processing unit 942 and a second data processing

10 unit 943 each provided in the CPU and having a packet
assembling/deassembling function, an internal bus 95 and a
selector 96. The CODEC 90 assembles and deassembles the packet
of the data corresponding to the media.

The TS-CONTL 91 takes the data out of a 64 Kbps time slot

15 of an internal transmission path between the control unit 50
and the CODEC 90, and inserts the data into the same time slot.
The DPRAM 92 enables the signal processing unit 53 of the control
unit 50 and the second processing units 941, 942, 943 of the
CODEC 90 to perform the internal communications therebetween.

20   The first voice processing unit 931 executes a process
of coding continuous signals of the voice data taken out of
the time slot in the TS-CNTL 91 into discrete signals of the
voice packet to the Internet line. Further, the first voice
processing unit 931 executes a process of decoding the voice

25 packet forwarded from the Internet line into the continuous
signals of the voice data, whereby the decoded signals can be
inserted into the predetermined time slot in the TS-CNTL 91.

The first FAX processing unit 932 executes a process of coding continuous signals of the FAX data taken out of the time slot in the TS-CNTL 91 into discrete signals of the FAX packet to the Internet line. Further, the first FAX processing unit

5 932 executes a process of decoding the FAX packet forwarded from the Internet line into the continuous signals of the FAX data, whereby the decoded signals can be inserted into the predetermined time slot in the TS-CNTL 91.

The first data processing unit 933 executes a process of

10 coding continuous signals of the data taken out of the time slot in the TS-CNTL 91 into discrete signals of the data packet to the Internet line. Further, the first data processing unit 933 executes a process of decoding the data packet forwarded from the Internet line into the continuous signals of the data, whereby

15 the decoded signals can be inserted into the predetermined time slot in the TS-CNTL 91. Note that the first data processing unit 933 neither encodes nor decodes the data, and, instead, there may be taken a process of merely letting the data through.

The second voice processing unit 941 and the second FAX

20 processing unit 942 control the first voice processing unit 93a and the first FAX processing unit 932 corresponding thereto, and executes the packet assembly including the addition of RTP for enabling the real time transport to be carried out and a packet deassembly including the elimination of RTP.

25 The second data processing unit 943 controls the first data processing unit 933, and executes the packet assembly and the packet deassembly.

The selector 96 receives a switching signal from the signal processing unit 53, and selects the first voice processing unit 931 or the first FAX processing unit 932 or the first data processing unit 933 in accordance with a content of this switching

5 signal, i.e., the media specified. Note that the CODECs 90 are extensible corresponding to an increase in the number of output channels to the LANs 7, 8 from the IP communication interface device 40.

The fourth IP communication interface device 40 is
10 connected directly to the highway of the highway switch 22 via the HW-IF 51, and may therefore be treated as the [trunk device] embraced by the ISDN relay line as viewed from the PBX 20.

(Operation)

In the fourth IP communication interface device 40 taking
15 the architecture described above, the voice data, the FAX data having the transmission speed of G3, or the 64 Kbps non-limited digital data are inputted as the Bch data via the HW-IF 51 of the control unit 50 to the TS-CNTL 91 of the CODEC 90 from the highway switch 22 of the PBX 20.

20 The signal processing unit 53 of the control unit 50 distinguishes between items of media data corresponding to the voice data, the FAX data and the data inputted from the highway switch 22 of the PBX 20 via the HW-IF 51, and transmits a switching signal to the selector 96.

25 The selector 96 receives the switching signal from the signal processing unit 53, and selects the first voice processing unit 931, or the first FAX processing unit 932 or the first data

processing unit 933 in accordance with a content of this switching

signal, i.e., the media specified.

To describe it in greater details, the signal processing

unit 53 of the control unit 50, when detecting a Dch signal in

5   which a transmission capability data element as the media data

is non-limited digital, transmits the switching signal to the

selector 96 via the HW-IF 51 and TS-CNTL 91. The selector 96

receiving the switching signal from the signal processing unit

53, selects the first data processing unit 933 in accordance

10   with the media specified. Further, the signal processing unit

53 of the control unit 50, when detecting a Dch signal in which

the transmission capability data element as the media data is

not non-limited digital, transmits the switching signal to the

selector 96 on the same route. Then, the selector 96 selects

15   the first voice processing unit 931. This process is the same

irrespective of whether the IP communication interface device

40 is set on the transmitting side or on the receiving side.

The signal processing unit 53, when detecting a NSF (Non

Standard Facilities) or DIS (Digital Identification Signal)

20   given from the FAX terminal 32 accommodated in the PBX 20,

identifies that the terminal is the FAX terminal 32 on the

receiving side, and transmits the switching signal to the

selector 96 on the same route as the above. Then, the selector

96 selects the first FAX processing unit 932. At this time,

25   the signal processing unit 53 transmits a [switching] Dch signal

to the transmission-sided IP communication interface device 40

on the opposite side via the LAN line.

Further, the signal processing unit 53, when detecting a normal end of the FAX procedure or a time-out of the switchover to FAX or a DCN (Disconnect) signal, transmits the switching signal to the selector 96. Then, the selector 96 selects the first voice processing unit 931 from the first FAX processing unit 932. Subsequently, the signal processing unit 53 transmits the [switching] Dch signal to the transmission-sided IP communication interface device 40 on the opposite side via the LAN line.

The signal processing unit 53, when receiving the [switching] Dch signal transmitted from the IP communication interface device 40 on the opposite side, transmits the switching signal to the selector 96, whereby the selector 96 selects the first FAX processing unit 932.

The voice data inputted to the TS-CNTL 91 are coded in the first voice processing unit 931 through the selector 96 and subjected to the voice compression and the silence compression based on the ITU-T G.729 Annex A/B. The coded voice data, which have been thus compressed, are transmitted to the second processing unit 941 via the internal bus 95 from the first voice processing unit 931. The second voice processing unit 6941 adds RTP to the coded voice data, thereby assembling a voice packet. This voice packet is transferred to the signal processing unit 53 of the control unit 50 via the DPRAM 92 and the internal bus 54 as well.

The signal processing unit 53 assembles the voice packet by adding a UDP header and an IP header to the former voice packet

received from the CODEC 90, and forwards this assembled voice
packet to the LAN lines connected to the LANs 7, 8 via the LAN-IF
52. The frame structure of the voice packet on the LAN line
and the Internet line is as shown in FIG. 4(A).

5   On the other hand, when the voice packet is inputted to
the IP communication interface device 40 from the LAN line, the
voice packet is deassembled and decoded into Bch voice data
through processing steps opposite to those described above. The
Bch voice data are then transmitted to the highway switch 22
10   of the PBX 20.

        The FAX data inputted to the TS-CNTL 91 are coded based
on the FAX relay method of FRP.11 in the first FAX processing
unit 932 having automatically detected inter-FAX-terminal
signals through the selector 96. The coded FAX data are
15   transmitted to the second FAX processing unit 942 via the internal
bus 95 from the first FAX processing unit 932. The second FAX
processing unit 942 adds RTP to the coded FAX data, thereby
assembling a FAX packet. This FAX packet is transferred to the
signal processing unit 53 of the control unit 50 via the DPRAM
20   92 and the internal bus 54 as well.

        The signal processing unit 53 assembles a FAX packet by
adding a UDP header and an IP header to the former FAX packet
received from the CODEC 90, and forwards this assembled FAX
packet to the LAN lines connected to the LANs 7, 8 via the LAN-IF
25   52. The frame structure of the FAX packet on the LAN line and
the Internet line is as shown in FIG. 4(B).

        On the other hand, when the FAX packet is inputted to the

IP communication interface device 40 from the LAN line, the FAX packet is deassembled and decoded into Bch FAX data through processing steps opposite to those described above. The Bch FAX data are then transmitted to the highway switch 22 of the

5 PBX 20.

The data inputted to the TS-CNTL 91 are coded as the necessity may arise in the first data processing unit 933 through the selector 96. The coded data are transmitted to the second data processing unit 943 via the internal bus 95 from the first

10 data processing unit 933. The second data processing unit 943 assembles a data packet on the basis of the coded data. This data packet is transferred to the signal processing unit 53 of the control unit 50 via the DPRAM 92 and the internal bus 54 as well.

15 The signal processing unit 53 assembles a data packet by adding a TCP header and an IP header to the former data packet received from the CODEC 90, and forwards this assembled data packet to the LAN lines connected to the LANs 7, 8 via the LAN-IF 52. The frame structure of the data packet on the LAN line and

20 the Internet line is as shown in FIG.4(C).

On the other hand, when the data packet is inputted to the IP communication interface device 40 from the LAN line, the data packet is deassembled and decoded into Bch data through processing steps opposite to those described above. The Bch

25 data are then transmitted to the highway switch 22 of the PBX 20.

Note that the process of transmitting and receiving the

control data (Dch data) of the call control signals which correspond to the TTC Standard JT-Q.931 message in this IP communication interface device 40, is the same as that in the first IP communication interface device 40 described above.

5   The function of the fourth IP communication interface device 40 explained above will be described more specifically. The function that will hereinafter be explained is the same as that of each of the first, second and third IP communication interface devices 40.

10   The signal processing unit 53 of the control unit 50 extracts a forwarding target number, i.e., an office number and an extension number out of received number data elements of the call control signals (Q.931 message) serving as the Dch control data from the PBX 20, then determines an IP address of a destination

15 (addressee) of the connection on the basis of the office number, and executes address mapping. Subsequently, the signal processing unit 53 sets the determined IP address in the IP header, and transmits the voice packet or the FAX packet or the data packet to the LAN line via the LAN-IF 52. On the other hand,

20 the signal processing unit 53 of the control unit 50, when receiving the voice packet or the FAX packet or the data packet from the LAN line via the LAN-IF 5, extracts only the received number data elements of the call control signal, viz., executes a receiving process without performing the address mapping unlike

25 the transmitting process.

     Further, with respect to the Internet 11 in which the routers 9, 10 capable of controlling the priority of the voice

packets are disposed, the signal processing unit 53 of the control unit 50, indicates the routers 9, 10 to set the priority by use of TOS (Type of Service) fields of the IP headers, and restrains a delay of forwarding the voice packets.

5   The second voice processing unit 943 of the CODEC 90 rearranges a sequence of regeneration within a range of the accumulated voice packet data. Namely, the second voice processing unit 943, if a transmission sequence of the voice data arrived is smaller than a transmission sequence of the

10   accumulated voice packet data, regenerates the voice data by decoding in the smaller transmission sequence.

A PB (Push Button) signal received in in-channel band from the PBX 20 is temporarily received and encoded in the CODEC 90, and the signal processing unit 53 of the control unit 50 converts

15   it into a call control signal (Q.931 message) and transmits the call control signal to the LAN line. When the PB signals are inputted in the form of control data from the LAN line via the Internet line, the control unit 50 indicates the first voice processing unit 931 of the CODEC 90 to convert these signals

20   into analog PB signals. The decoded PB signals are transmitted to the PBX 20 via the TS-CNTL 91 and the HW-IF 51 from the first voice processing unit 931.

Software of the CPU of the control unit 50 provided with the signal processing unit 53 and software of the CPU of the

25   CODEC 90 provided with the second processing units 941, 942, 943, can be downloaded from outside via LAN ports based on TCP/IP (10BASE-T or 100BASE-TX).

Further, it is feasible to obtain statistic data, fault data and trace data from outside via the LAN ports based on TCP/IP (10BASE-T or 100BASE-TX). Namely, in the IP communication interface device 40, various items of statistic data such as the number of transmitted/received packets and a line activity ratio are collected and accumulated in order to grasp an operation state and actualize an effective utilization of the line. Further, the data about faults occurred during the operation are collected and accumulated as a log. The Dch data of the call control signals are collected and accumulated as the trace data for monitoring the transmitted/received data.

Although only a few embodiments of the present invention have been described in detail above, those skilled in the art will readily appreciate that many modifications are possible in the preferred embodiments without departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of the present invention as defined by the following claims.

WHAT IS CLAIMED IS:

1. An IP communication interface device comprising:

first and second connecting units for making it possible to dispose between a switched circuit network and LAN connected to an IP packet switched network;

a first processing unit for coding first media-corresponding data as B-channel data inputted to said first connecting unit from said switched circuit network, decoding packet-deassembled media-corresponding data into which a packet of second media-corresponding data inputted to said second connecting unit from said LAN is deassembled, and for transmitting the decoded media-corresponding data to said first connecting unit for forwarding the same data as the first media-corresponding data to said switched circuit network;

a second processing unit for assembling the coded media-corresponding data coded by said first processing unit into a packet, deassembling the packet of the second media-corresponding data, and transmitting the same data as packet-deassembled media-corresponding data to said first processing unit; and

a third processing unit for generating the second media-corresponding data by adding predetermined header data to the packet-assembled media-corresponding data assembled into a packet by said second processing unit, forwarding the second media-corresponding data to said LAN via said second connecting unit, removing the header data added to the second media-corresponding data inputted to said second connecting unit,